U.S. DEPARTMENT OF ENERGY
OFFICE OF SCIENCE AND TECHNOLOGY
TECHNICAL ASSISTANCE
TO
THE OHIO FIELD OFFICE

DRAFT REPORT

CHARACTERIZATION OF UNDERGROUND PIPING CONTAMINATED WITH RADIONUCLIDES AT THE MIAMISBURG, COLUMBUS, AND ASHTABULA ENVIRONMENTAL MANAGEMENT PROJECTS

SEPTEMBER 2002

EXECUTIVE SUMMARY

The Department of Energy (DOE) Ohio Field Office submitted a number of technical assistance requests, which included requests focused on the characterization of underground piping at the three Ohio sites. DOE's Office of Science and Technology (OST) convened a team of national experts in the area of radiochemistry, health physics, decontamination and decommissioning, and environmental engineering to develop solutions for problems at the three sites. Each of three sites, Miamisburg, Ashtabula, and Columbus, have significant underground piping that may have to be characterized, removed, and properly disposed. Development of a rationale and strategy to demonstrate that piping can be left in place safely will provide significant benefit to DOE.

The Technical Assistance Team (TAT) held a workshop at the Mound Site in Miamisburg Ohio in June of 2002 where discussions were held with staff from each of the three DOE sites and with staff from the Ohio Field Office. At the end of the two-day workshop, the TAT gave an oral briefing to appropriate attendees. This report provides written documentation of the recommendations developed by the TAT.

The TAT recommends the use of the Graded Approach for characterization of underground piping at facilities like the Ashtabula Environmental Management Project, where some piping may be located in areas not contaminated or may contain some radionuclides that can be easily remediated in place. The Graded Approach, utilized during decontamination and decommissioning activities at numerous commercial nuclear facilities, is based upon the concept that piping with lesser potential for contamination requires a less robust characterization plan than piping with higher potential for contamination. The TAT also strongly recommends that Ashtabula staff work with the appropriate regulatory bodies to determine rational release criteria specific to buried underground piping systems, which should be less stringent than those for surface facilities. At Ashtabula, nine underground lines, totaling more than two thousand linear feet, are excellent prospects for the use of the Graded Approach to demonstrate that the piping can be left in the ground. The TAT has offered to assist the Ashtabula staff in the specific plan for the implementation of the Graded Approach for this application.

The TAT also recommends further investigation of two alternatives for the T-Building North Hot Waste Line at the Miamisburg Site: removal or remediation. A number of potential remedial technologies are described in terms of advantages and disadvantages. The TAT offers additional services to further evaluate the various technology options surrounding remediation or removal and provide information on commercial vendors for the preferred option.

BACKGROUND

The Department of Energy (DOE) Ohio Field Office submitted a number of technical assistance requests to the DOE Office of Science and Technology in March of 2002. Three requests for technical assistance were focused on the characterization of underground piping at the respective sites: Miamisburg Environmental Management Project (MEMP) Characterization of Contaminated Piping Inside, Between, and Underneath Buildings (MEMP-02-02), Columbus Environmental Management Project (CEMP) Characterization of Contaminated Piping (CEMP-02-06), and Ashtabula Environmental Management Project (AEMP) Pipe Explorer (AEMP-02-02).

GENERAL PROBLEM STATEMENT

MEMP, CEMP, and AEMP plan to spend significant resources to characterize, decontaminate and/or possibly remove subsurface piping, sewer lines, and drain lines at their respective facilities. At MEMP and AEMP, plans include analysis of contaminants to determine whether the piping can be decontaminated and verified clean so that it can be abandoned in place or whether it must be removed. Some of these process pipes are believed to be highly contaminated and thus, it will not be cost effective to attempt to decontaminate them to unconditional release levels. Other piping systems (i.e. storm sewer lines, fire lines, abandoned water lines) may be clean or easy to decontaminate. At CEMP, current plans include removal of all piping.

MEMP has approximately 16,000 linear feet of sanitary sewer lines and 34,000 linear feet of storm sewer. AEMP has approximately 9,000 linear feet of buried piping, based on preliminary screening surveys of plans and drawings. CEMP has approximately 4,000 linear feet of sanitary sewer lines and 4,000 linear feet of storm sewer.

REQUEST

DOE-OH, MEMP, AEMP, and CEMP requested technical assistance to evaluate in-situ characterization technologies and approaches to characterization of piping at each of the three sites. Appendix A contains the statement of work prepared from these three technical assistance requests.

APPROACH

EM-50 identified a team of experts with various technical backgrounds such as health physics, radiochemistry, decontamination and decommissioning, and environmental engineering to assist with these requests. The Technical Assistance Team (TAT) is comprised of experts from DOE laboratories, academia, and the commercial nuclear industry (see Appendix B for biographies of the experts).

The TAT met at the MEMP site on June 26 and 27th, 2002 to discuss all three technical assistance requests. Before the meeting, each of the three sites provided background information regarding the specific problems at their site. The TAT reviewed these materials before the meeting and was then briefed on additional information at the meeting (see the agenda in Appendix C). Discussions in collaboration with the site representatives to better understand the problems and identify solutions were held over the two-day period. At the end of the meeting, the TAT prepared an oral report. This report provides written documentation of the team's recommendations.

COLUMBUS PROBLEM DESCRIPTION

DOE-OH and CEMP submitted a deployment assistance request to OST in March 2002 for the in-situ characterization and stabilization of the underground piping at the site. Piping at the site consists of 4000 linear feet of sanitary lines and 4000 linear feet of storm sewer buried from 3 to 30 feet deep. Piping consists of steel, clay tile, and plastic, ranging from 4 to 24 inches in diameter. Cesium-137 is the predominant radionuclide of concern. In 2000, approximately 80% of this piping (that greater than 4" in diameter) was surveyed using the Pipe Explorer with a 1" x 1" sodium iodide detector and a Geiger-Mueller counter to determine cesium activities in the piping. Piping not surveyed included sanitary lines that were too small and crushed piping. Some problems with data interpretation occurred due to difficulties in determining background. However, these data will be utilized to assist with planning of the removal and disposal actions, recently agreed to by DOE and Battelle, the site owner. No additional surveying will be performed. Because conditions changed between the time that the technical assistance (TA) request was submitted and the time of the TA meeting, there was no longer a need for OST to provide assistance to CEMP. However, Tony Poliziani of Battelle Columbus attended the TAT meeting to share lessons learned at CEMP with the TAT and the end users at AEMP and MEMP.

AEMP PROBLEM DESCRIPTION

Current baseline at AEMP calls for excavation of all subsurface piping. Approximately 9,000 linear feet of piping, 2"-30" in diameter, is present at 5 to 30 feet below grade. Of this total, five thousand linear feet of piping, much of it process piping, is located below building slabs and is believed to be contaminated and thus must be removed. The remainder, four thousand linear feet of piping is located outside of the contaminated footprint and is likely uncontaminated or could be cleaned in place. If some of this piping could be left in place, significant cost savings could be realized, as removal is estimated to cost \$3 to 4 million dollars.

Staff at AEMP requested that the team examine an approach to address nine underground lines (>2000 linear feet) that are likely not contaminated and therefore could be proposed to be left in place. A map of the lines and a table describing their characteristics are provided in Appendix D. These lines were utilized for stormwater in or adjacent to clean areas. The primary contaminants anticipated are uranium and technetium-99. In 2002, many of these lines were pressure washed and videotaped. Some of the pipes had thick, unremovable lime scale deposits.

MEMP PROBLEM DESCRIPTION

Current baseline at MEMP calls for excavation and removal of all underground piping. In addition to numerous process lines, MEMP also has approximately 16,000 linear feet of sanitary sewer lines and 34,000 linear feet of storm sewer lines. The original technical assistance request focused on developing an approach to determine which lines could be left in place, thus saving significant money.

When the team arrived at Miamisburg, the staff requested that the team focus their efforts on the process line located below the DS Building and above the underlying T Building (also known as the T-Building North Hot Waste Line). This process line cannot be easily excavated and removed due to building interference and so represents a more difficult and expensive problem than the remainder of the piping on site. This process line, ranging from 8" in diameter beginning at Manhole 10 to 2" in diameter at its extremity, is embedded in concrete located within a six-foot vertical space between the two buildings. The line was fed by pumping of waste through vertical pipes in T Building, which are also likely to be contaminated and may require some action. One issue noted by the TAT is that in a Mound report dated May 1973, it was stated that this 8" hot waste line had developed a leak and so was plugged and replaced by a 3" steel pipe placed on top of the concrete encasement. There is no further mention of this 3" line in any other document. Thus, the TAT assumed that the TA request was to help develop a solution for the original North Hot Waste Line.

T Building was constructed to produce polonium-210 sources. Bismuth targets irradiated at Savannah River or Hanford, containing numerous radioisotopes, were processed using a variety of strong acids to extract the polonium-210. Wastes from theses processes were collected in sumps and then pumped up vertical pipes inside the T-Building to the process line located above T Building. The North Hot Waste Line received waste from one sump, identified as #10 and as #11 in two different slides. Records indicate that the process line is made of clay tile and extends for approximately 300 feet under the DS-Building, but the total pipe length is 485 feet (SEA document says 500 feet). There is access to the pipe through a manhole (#10) to the south of the DS Building.

In 1996, radiological (sodium iodide detector) and video surveys using the Pipe Explorer began at Manhole 10 and extended for 260 feet through the T-Building North Hot Waste Line; the radiological survey demonstrated that the primary contaminant, believed to be cobalt-60 generally ranged in activity from 7,000 to 14,000 pCi/100 cm^2. However, other unidentified radionuclides were noted in the gamma spectra. Both continuous surveillance for cobalt-60 and eight total gamma isotopic analyses were completed on four lines, one of which is the T-Building North Hot Waste Line. The video survey showed that approximately 50% of this pipe run contains solids and debris. Radiological surveys demonstrated that the sources of radioactivity generally coincide with the areas containing solids and debris. More than 30 sources of contamination, of which the maximum was more than 700,000 pCi/100 cm^2, were detected within the pipe. However, the bulk of the contamination was found between 200 and 231 feet, encompassing the location where the number-10 sump enters at 205 feet. It is believed that the cobalt-60 is present as discrete insoluble particles, possibly undissolved aluminum cladding. Video surveillance also demonstrated that the pipe is not intact, as groundwater flows into the pipe at four separate locations.

Further complicating the problem is the fact that a sanitary line is located adjacent to this process line (one foot away), embedded in the same concrete mass (approximately 4’4” wide and 2’7” deep). DOE would like to see this sanitary line remain intact.

RECOMMENDATIONS FOR RADIOLOGICAL CHARACTERIZATION OF UNDERGROUND PIPING: THE GRADED APPROACH

The TAT recommends the use of the Graded Approach for radiological characterization of underground secondary piping at facilities where radioactive materials were processed. Secondary piping is defined as non-process piping that has some potential for contamination due to its proximity to a radioactive source term or due to possible connections to contamination events over the course of a lengthy facility operating history. Piping in this category typically includes storm and sanitary sewers. The recommended approach, identified here as the Graded Approach, is based on TAT experience with investigation and characterization of embedded and underground piping at several commercial nuclear facilities, including Shoreham, Ft. St. Vrain, Trojan, and several research and test facilities. This approach also draws on concepts published in Federal guidance documents (MARSSIM[1], NUREG/CR-5849).

The Graded Approach is depicted using a logical decision pathway (Figure 1). The pathway shows a sequence of evaluations, each followed by a determination as to whether additional investigation is needed. When utilizing the Graded Approach, the initial assumption is that the piping is considered suspect, i.e., system is considered impacted until process knowledge or physical measurements prove otherwise.

The Graded Approach in Figure 1 depicts how this could be applied for the evaluation of underground storm sewers at MEMP and AEMP, but is considered to be applicable at other facilities where some or all of the following assumptions apply:

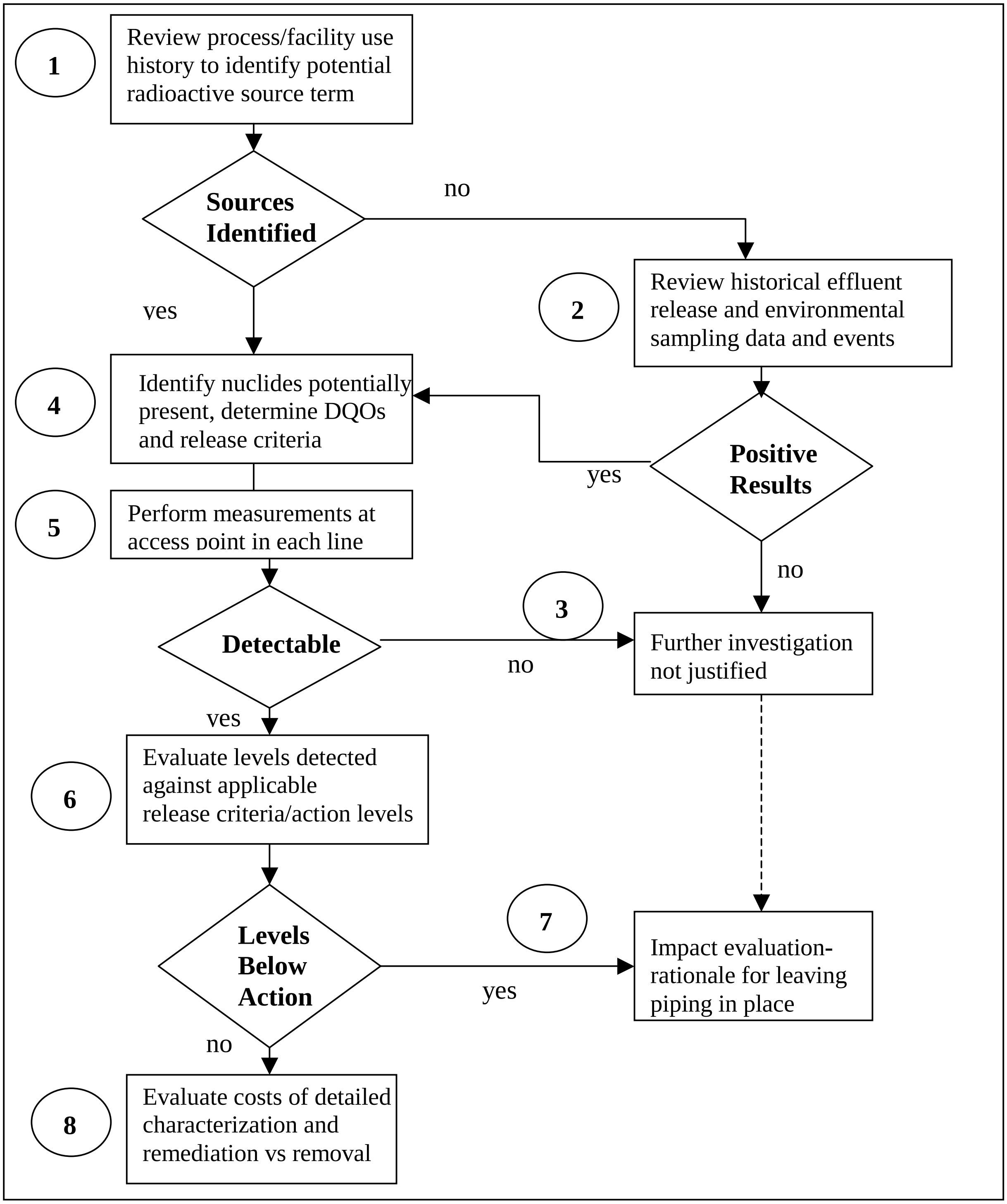
- piping does not have direct connection to radioactive source term;
- there is a possibility of indirect ingress for contaminants;
- drawings showing piping layout and location at the facility are available and considered accurate;
- reasonably reliable historical process data are available for areas and facilities with possible connection to the piping; and
- access to piping is readily available, e.g., either through manholes, cleanouts or outfalls.

[1] Multi-Agency Radiological Site Survey and Investigation Manual, U.S. EPA, December 1997.

The Graded Approach is a systematic method that provides a pathway to verify the initial assumption that the piping is unaffected and can yield justification for “no further action required.” Alternatively, if results of the investigation do not support this assumption, the piping classification is changed to “suspect” or “affected” and additional characterization and evaluation is recommended.

The decision pathway in Figure 1 is discussed below in detail. It should be noted that this approach is not intended to serve as a prescription or procedure for collection but as a planning guide for confirming the status of contamination in underground piping.

Figure 1. Decision Logic for Evaluation of Low-Probability Piping



Step 1: Review Process History

Facility historical records should be reviewed to determine if facilities or areas adjacent to or serviced by storm sewers could have provided sources of radioactive contamination that entered the lines under evaluation. This includes review of records of radionuclide inventories in facilities serviced by storm sewers and review of spill events, floods or other events. If possible, conduct interviews of current and past employees familiar with the operation of the facility and off-normal events. The product of this task includes a listing of radionuclides (and their chemical form, if possible), concentrations and amounts handled and identification of events that could have caused contaminants to enter the storm-sewer system. If process history records are not available or are of inadequate quality to determine if radionuclide sources were available for release to sewers, additional investigation through collection of samples and measurements is warranted. See step 4 described below.

Step 2: Review Environmental Monitoring Data

Historical environmental monitoring data are reviewed to determine if there is evidence of storm-sewer contamination. The most direct evidence is positive results from storm-sewer outfall/effluent sampling. Positive results, i.e., detectable levels of facility-related radionuclides from historical and current environmental air and water sampling, should also be evaluated. Results from surface and ground-water sampling should be evaluated as evidence for potential release pathways involving storm sewers. A potential pathway can be from ground-deposited air effluents that wash into storm sewers in surface-water run-off and through roof drains. Therefore, air effluent and environmental air data should be evaluated. Note that if environmental monitoring data are not available, further investigation is needed as outlined in steps 4 and 5.

Step 3: Further Investigation Not Justified

Assuming that there is sufficient information from process history and environmental sampling results and these show that there is no history of radioactivity or detectable concentrations in the local environs, reasonable assurance is provided that the initial assumption is correct, i.e., the piping is unaffected. Hence, further investigation is not justified. There is an alternate path to this same conclusion, the path proceeding through steps 4 and 5, where potential sources were identified and measurements made but no detectable activity was measured (Figure 1).

Once step 3 is achieved, the process is completed with step 7, development of a rationale for leaving the piping in place, or disposing of it as conventional demolition waste, if removal is required by the site restoration plan.

Step 4: Determine Data Quality Objectives and Release Criteria

This step is invoked when either of steps 1 or 2 result in identification of the potential for the presence of radioactive contamination in the subject piping. This step envisions limited sampling and measurements through available access points to the sewer system under investigation. In order to ensure that appropriate and sufficient information is collected, Data Quality Objectives (DQOs) must be developed.

The basic decision-objective to be evaluated in the sampling effort is: are radionuclides present in the sewer system in concentrations above a significant fraction of applicable release criteria? The sampling effort is designed accordingly, as follows:

- Determine release criteria or decision limits for each of the radionuclides potentially present, e.g., concentrations on piping surfaces (dpm/100-cm^2). Work with the appropriate regulatory bodies to determine the release criteria specific to this problem, that of underground piping. Release criteria for building surfaces should not necessarily be the same as those identified for the interior surfaces of buried pipe, especially if the pipe is grouted in place, thus reducing the potential for public exposure.

- Establish minimum sensitivities for the sampling and measurements as a suitable fraction of the release criterion. For example, if the release criterion for uranium in piping were 1000 dpm/100-cm^2, a realistic target detection-sensitivity for in-situ surface-activity measurements would be 500 dpm/100-cm^2.

The analytical strategy has two steps:

1. Material samples such as sludge or residue are collected and analyzed to identify individual facility-related radionuclides (if any), and

2. Measurements are performed to quantify surface activity. Detailed knowledge of the type of radiation emitted from the radionuclides identified is necessary to select the appropriate type of measurement. Examples of measurement type include direct measurement for gross surface activity or in-situ isotope-specific analyses. Once the measurement method is decided, the appropriate instrumentation can be selected to make those measurements. The example assumes that the primary contaminants are from decay series with beta emitters. If not the case, tritium or alpha emitters, weak gamma emitters, or x-rays require different measurement strategies.

Inspections of available access points are conducted to ascertain the presence of sludge, scale or other residue from which samples may be collected. Also, access to piping surfaces should be confirmed and piping dimensions should be verified to ascertain what instrumentation is needed for surface activity measurements.

Consideration should be given to estimating the number of measurements needed to implement a decision framework, including selection of acceptable type I and II decision-error probabilities.

Step 5: Perform Measurements at Selected Access Points

Ideally, at least one access point should be sampled for each sewer line under investigation. If manholes are present, they should be the first choice, as they are typically of such construction to allow direct access to piping surfaces with hand-held instruments. In the absence of access to piping that allows use of hand-held instruments, semi-remote piping-system measurement tools are required. Typically surface-activity measurements are collected on the bottom of the piping surface and along the sides if a “bathtub” line is present. Measurements at piping joints are desired as well. Samples of residue if, present, should also be collected. Due consideration should be given to determination of instrument background and measurement efficiency for surface-activity measurements, measurement geometry and radionuclides being measured.

Step 6: Evaluate Measurement Results

Measurement results are evaluated against decision limits (release criteria) developed in step 4. Assuming that measurement sensitivities are below the release criteria for the primary radionuclides of concern, the measurement results should be of acceptable quality to support or reject the initial assumption. Given that sufficient measurements are available, use of a hypothesis-testing procedure will strengthen the credibility of the conclusion. Alternately, confidence intervals can be calculated and the upper confidence limit of the mean (at the 95% confidence level) compared to the acceptance criterion.

Step 7: Develop Rationale for Leaving in Place

If it is demonstrated that the piping is not contaminated or is below levels requiring remediation or removal, the evidence is summarized. However, further rationale may be needed to satisfy stakeholders. This may be provided via risk assessments using acceptable future land -use scenarios.

Step 8: Further Characterization Required

If the evaluation in step 6 determines that the piping is contaminated, an additional evaluation is conducted to determine disposition of the piping. A detailed discussion of this process is considered to be outside the scope of the present discussion, but the alternatives are summarized. Two alternatives are available:

- Leave the piping in place – with acceptable mitigating measures

- Remove and dispose of the piping - likely as radioactive waste.

Appendix E provides information on commercially available technologies for characterization of piping applicable to problems described in this report. Each technology is described in terms of applicability, capabilities, and limitations. Vendor contact information is also provided. Appendix E also contains a table of pipe deployment platforms.

RECOMMENDATIONS FOR PIPING-DISPOSITION DECISION- MAKING

At this point, it is necessary to evaluate the relative costs of the alternatives before proceeding. The alternatives typically consist of decontamination (remediation) in place or removal. In general, the burden of proof for proposals to remediate and leave piping in place is higher than for the removal option; as such, the proposal must include a detailed description of a solid technical approach that demonstrates the remediation will be successful and the risk of leaving the piping in the ground is very low.

If a decision is made to decontaminate and leave the piping in place, the performance of the decontamination process must be demonstrated to show that the job was completed as planned. This means that the cost of "decontaminate and leave piping in place" alternative includes both the cost for the actual decontamination and for post-decontamination surveying. In addition, stakeholders may require an assessment of the risks associated with leaving the piping in place. This will add to the cost of this option.

For typical storm sewer lines, it is expected that removal and disposal costs will be of the same order as the cost to decontaminate and survey in place. For piping embedded in concrete, the unit removal costs are usually significantly higher and thus the "decontaminate and leave the piping in place" option becomes more desirable.

Table 1 identifies physical and chemical methods for in-situ decontamination of embedded or underground piping. See Appendix D for a discussion of in-situ characterization technologies.

Table 1. In-situ Decontamination Methods for Piping

Method	Advantages	Limitations
High-pressure water jetting	• Moderate cost • Can vary pressure to obtain best results • 360-degree nozzle design cleans at one pass • Effective in small-diameter piping • Can clean long lengths from one setup location • Negotiates multiple bends • Effective on variety of piping material	• Liquid waste management issue (may be large volumes) • Water/waste may reach subsurface through pipe breaks • Danger to workers from handling high-pressure lance • Difficult to focus – may require multiple passes with surveys in traps and joints • Works well for relatively loose contamination • May generate mixed waste • Complex equipment and waste treatment/handling skids
Grit blasting	• Moderate cost • Aggressive – expect good results from single pass • Dry waste with reduced waste volumes from grit recycle • Waste disposition easy • Effective in piping up to 24 " in diameter • May be ineffective on long sections of piping • Effective on variety of metallic piping materials	• More complex than water blasting - requires vacuum system to recover grit • May require experimentation with grits, pressure to obtain best results
Other mechanical cleaning (rotating brushes)	• Low cost • Simple equipment	• Poor precision – control of tool location • Limited to fairly short-straight pipe runs • Need to provide means for recovery of debris • Performance variable
Chemical decontamination	• Strong reagents • Good coverage - system is hard-plumbed to piping • Pipe dimension not limiting • Effective on complex pipe runs	• Complex equipment and waste treatment/handling skids • Long lead time for setup and testing • Could generate mixed waste • Limited to ferrous piping

GENERAL RECOMMENDATIONS FOR DEMONSTRATION OF DECONTAMINATION EFFECTIVENESS

If the alternative for "decontamination and leaving the piping in place' is selected, the following steps must be completed to demonstrate the effectiveness of the decontamination process. This surveying process includes steps to be taken both prior to and after the decontamination is completed.

- Collect samples and perform direct measurements to characterize the materials/facility/equipment being decontaminated.
- Develop scaling factors for radionuclides difficult to measure based on sample analysis. This will allow measurement of targeted radionuclides post-decontamination and calculation of total radionuclide activity, as opposed to measurement of all known radionuclides.
- Establish target goals for the radionuclides known to be present to be achieved post decontamination.
- Perform decontamination process
- Perform direct measurements post-decontamination to determine if the process removed the necessary contamination to achieve the required goals. If a single radionuclide such as ^{60}Co is selected to assess the post-decontamination radiological condition, use the scaling factors developed earlier to calculate the total radionuclide activity of all known radionuclides.
- If the decontamination process did not achieve the desired goals, evaluate the process to determine if repeating the process is sufficient or if another decontamination method will be necessary.

The TAT noted that Reg Guide 1.86 typically governs unconditional-release requirements, but ALARA (as low as reasonably achievable) arguments have been utilized for piping at commercial nuclear power plants, such as Fort St. Vrain in Colorado. The recent adoption of risk or dose-based release standards (i.e. NRC's 25 mrem/year limit) should allow for significantly higher levels of residual radioactivity in buried piping. In addition, risk due to the presence of underground piping can be decreased significantly by grouting. These arguments can be utilized to advance the concept of leaving piping in place, which is a very different situation from free-release of walls and other structures.

MEMP RECOMMENDATIONS

The TAT recognizes that MEMP has confirmed that the T Building North Hot Waste Line contains radioactive contamination at levels that require some type of remediation or removal of the piping. The TAT recommends that further evaluation be conducted to investigate the costs and technical risks associated with piping removal versus remediation and survey in place. If a decision is made to pursue remediation in place, cost estimates must also include the post-decontamination surveying, as described above in the previous section.

Table 1, above, describes various options for remediation in place. Preliminary analysis indicates that the grit blasting or some other type of dry decontamination may provide the best option for remediation in place. Because it is likely that this pipe leaked in the past, the use of water or a liquid chemical to remediate would be a weak option. If the piping is remediated and grouted in place, prior leakage of radionuclides through cracks into the surrounding concrete would not likely be a significant risk. However, if the radionuclides have migrated beyond the concrete into the soil, concerns regarding remediation in place versus removal would be likely.

If requested, the TAT could conduct further analyses of these options to estimate the cost and technical risk of each remediation technology for the specific Mound application; vendors for various options could also be identified.

The TAT recommends a demonstration of the decontamination technique downgradient of the embedded pipe near Manhole 10, where access is less difficult, prior to full deployment The TAT does not currently recommend additional characterization of the main line, but TAT recommends sampling immediately upgradient of Manhole 10, including collection of sediment or wall scraping, and sampling of the branch line from within the T Building, if possible to assist with identification of the proper characterization tools for the post-decontamination survey. The TAT could provide assistance with identification of sampling and analysis procedures associated with this characterization effort.

The alternative of pipe removal is also a viable option. Directional drilling companies can provide services to drill out the pipe along with a small volume of the concrete encasement. Discussions with a potential vendor indicate that the technical risk is low, however a number of issues such as introduction of drilling fluids and cost do exist. The TAT could pursue collection of cost and risk data regarding removal options using directional drilling and they could also identify potential vendors. Directional drilling technology is well known by one of the TAT members. The removal option would not address removal or remediation of the branch line from the T Building, but removal does offer an advantage in that it could include removal of a portion of the surrounding concrete where radionuclides likely migrated during leaks.

Collection of cost information for the remediation and removal options is urgently needed, as it appears that current piping removal estimates do not account for the complexity involved in removing this one section of pipe that is located between two buildings and cannot be excavated. The current baseline addresses only normal excavation of a 6-foot by 6-foot volume of soil surrounding all pipes.

AEMP RECOMMENDATIONS

The TAT recommends that AEMP utilize the Graded Approach as outlined above to characterize the nine runs of sewer line that pose the most potential for leaving in place. The TAT also recommends the consideration of adopting risk or dose-based cleanup standards for the sewer line, if significant levels of contamination are detected. The TAT could assist with the decision logic by reviewing facility use information, identifying the potential radionuclides present, developing DQO's, recommending instrumentation for the measurements to be made, and reviewing the request for proposals for the actual field measurements. The request for proposals should be written as a performance-based document rather than to a specific vendor.

Preliminary discussions regarding potential radionuclides indicated that with technetium-99 present, other fission products might be present. The TAT could assist in the selection of radiation detection equipment after detailed characterization reports have been reviewed. The TAT also recommended review of the analytical data for the water used to flush this piping to assist with identification of potential radionuclides of concern. The TAT could also review the data collected during the field characterization and evaluate it against the applicable release criteria.

APPENDIX A
UNDERGROUND PIPING CHARACTERIZATION TECHNICAL ASSISTANCE TEAM SCOPE OF WORK

OHIO TECHNICAL ASSISTANCE REQUESTS: CHARACTERIZATION OF UNDERGROUND PIPING CONTAMINATED WITH RADIONUCLIDES AND OTHER CONTAMINANTS

MIAMISBURG ENVIRONMENTAL MANAGEMENT PROJECT
REQUEST NO. MEMP-02-02
CHARACTERIZATION OF CONTAMINATED PIPING INSIDE, BETWEEN, AND UNDERNEATH BUILDINGS

ASHTABULA ENVIRONMENTAL MANAGEMENT PROJECT
REQUEST NO. AEMP-02-02
PIPE EXPLORER

COLUMBUS ENVIRONMENTAL MANAGEMENT PROJECT
REQUEST NO. CEMP-02-06
CHARACTERIZATION OF CONTAMINATED PIPING

PROBLEM STATEMENT

The Miamisburg Environmental Management Project (MEMP), the Ashtabula Environmental Management Project (AEMP), and the Columbus Environmental Management Project (CEMP) plan to spend significant resources to characterize and possibly remove subsurface piping, sewer lines, and drain lines at their respective facilities. At MEMP and AEMP, plans include analysis of contaminants to determine whether the piping can be decontaminated and verified clean so that it can be abandoned in place or whether it must be removed. At CEMP, current plans include removal of all piping; CEMP is interested in characterization technologies to determine optimum methods for safe, cost-effective removal.

MEMP has approximately 16,000 linear feet of sanitary sewer lines and 34,000 linear feet of storm sewer. AEMP has approximately 9,000 linear feet of buried piping, 2” – 30” diameter at 5’ – 30’ below surface grade (bsg), based on preliminary screening surveys of plans and drawings. Approximately 5,000 linear feet (lf) is below contaminated slabs and must be removed. Some of these process pipes are known to be contaminated and not free-releasable even with aggressive decontamination. Others (i.e. storm sewer lines, firelines, abandoned water lines) may be easy to decontaminate or may be clean. The other 4,000 lf are located outside the contaminated footprint and may be clean or relatively easy to decontaminate. CEMP has approximately 4,000 linear feet of sanitary sewer lines and 4,000 linear feet of storm sewer.

REQUEST

DOE-OH, MEMP, AEMP, and CEMP are requesting technical assistance to evaluate in-situ characterization technologies (such as Pipe- Explorer) and approaches to characterization of piping at each of the three sites.

SCOPE

EM-50 has identified a team of technical experts with various backgrounds to assist with these requests. The team is currently scheduled to meet at the MEMP site on June 26 and 27th, 2002. The three sites will provide information regarding the specific problems at each site to the technical assistance team. The team will review materials before the meeting and will be provided additional information at the meeting. The team will then discuss technology solutions, in collaboration with site representatives. The team will prepare an oral report to be presented at the end of the meeting and a written report to be completed within three weeks after the meeting. The reports, oral and written, will contain recommendations on technologies and approaches for cost-effect, safe solutions. After the written report is completed, some portion of the team shall be available for consultation during project implementation. The consultation may range from phone calls, emails, to site visits. It is also anticipated that this same team, with possible additions, may be utilized in the future to provide technical assistance to Rocky Flats, where similar problems exist.

SCHEDULE

Proposed schedule, which is subject to change:

- Team Identified May 31, 2002
- Team Meeting June 26-27, 2002
- Draft Report July 18, 2002
- Final Report August 1, 2002

APPENDIX B
TECHNICAL ASSISTANCE TEAM BIOGRAPHIES

Bruce Mann, Radiological Services, Inc.
Bruce Mann has more than thirty-five years of experience in Health Physics and Nuclear and Environmental Engineering. Prior to joining Radiological Services, Inc 1999, he was employed in the Commonwealth Edison Nuclear Organization from 1997 to 1999 as a technical expert for decommissioning and environmental services. He served as a consultant from 1980 to 1997 for Nuclear Industry and Government organizations including EPRI, Portland General Electric (TTX), Public Service Co. of Colorado, General Electric, Westinghouse, the National Academy of Sciences, the US Senate and the President's Commission on the Accident at Three Mile Island. During this period, he participated in several large nuclear outage and decommissioning projects. He was also employed in Federal Agencies (US Public Health Service and USEPA) for 11 years, working in environmental radiological monitoring and evaluation.

Earlier in his career, Bruce served as a health physicist at nuclear research facilities where he held operators licenses at two research reactors. He has considerable experience in site investigation, characterization and final status surveys, including Uranium mine and mill sites, low-level waste disposal sites and nuclear reactor facilities. He played a key role in license termination radiological surveys for UC Berkeley, Shoreham and Fort St Vrain reactor decommissioning. He holds MS degrees in Nuclear Engineering and Bioradiology. He is a Certified Health Physicist and registered professional engineer in Nuclear Engineering.

Richard Sexton, Kaiser Hill Rocky Flats
Mr. Sexton has more than 20 years experience in commercial nuclear operations. He has successfully directed and managed a variety of radiation protection, safety, waste management, and decommissioning organizations. He holds two patents for monitoring radioactivity in piping and has published numerous papers on decommissioning. Currently, he is the Rocky Flats Radiation Safety Site Manager. He has held senior management positions at a variety of reactor and DOE decommissioning projects since 1991, including Safety Manager for Connecticut Yankee Decommissioning Project, one of the most challenging and high-profile reactor decommissioning projects currently performed. He was a key team member in Fort St. Vrain Decommissioning Project and the demolition of the first building at Rocky Flats.

Dawn Kaback, Concurrent Technologies Corporation
Dr. Kaback has more than twenty-five years experience working in the environmental field for government and industry, focusing on science and technology. She received her Ph.D. and M.S. degrees in geochemistry from the University of Colorado and her B.S. in Earth and Space Science from the S.U.N.Y. at Stony Brook.

Dr. Kaback directed environmental research and technical service projects associated with mining and petroleum extraction/refining for Conoco Inc. At the DOE Savannah River Technology Center she worked in both a technical and management role applying innovative characterization and remediation technologies to environmental cleanup problems. This work was focused on innovative drilling, sampling, and remediation technologies targeted to clean up volatile organic compounds in groundwater and the vadose zone.

Dr. Kaback is the Director of the Ground Water Remediation Technologies Analysis Center (www.gwrtac.org). She currently serves as a Director of the Board of the Association of Ground Water Scientists and Engineers Division of the National Ground Water Association, is an editor for *Ground Water Monitoring and Remediation*, has served on a National Academy of Science Committee overseeing the U.S. Geological Survey's Water Resources Research Program, has chaired and participated on numerous technical advisory committees, is a co-inventor on several patents focused on innovative remediation technologies, and teaches workshops on the application of horizontal environmental wells for groundwater remediation.

David Roelant, Florida International University – HCET

Dr. Roelant received his Ph.D. from the University of Michigan in Nuclear Engineering. He is the Sensors, Automation and Robotics Program Manager at Florida International University's Hemispheric Center for Environmental Technology. Dr. Roelant has been involved with performing or managing research and development for the past 25 years. Over the past 11 years, he has either lead or provided technical management to more than 400 R&D projects valued over $120M. These projects have ranged from new research to rapid engineering improvements to existing technologies. R&D has included: sensors and long-term monitoring systems for soil, groundwater, landfill, and facility applications; DNAPL characterization technologies; improved radiation-detection systems; nondestructive assay and evaluation systems; geophysical techniques; and remote-sensing technologies.

During this time, he has with worked with experts from academia, industry and national laboratories in developing new sensors, long-term monitoring modeling, remote-sensing technology and improved characterization and sampling strategies. He has developed numerous field-deployable sensors and turn-key sensor data-acquisition, analysis, and decision-support systems. He has also helped manage the development, testing, and evaluation of numerous sensor systems from national laboratories and private industry for the U.S. Department of Defense and the DOE for the past 11 years.

Ron Smith, Westinghouse Savannah River Company

Mr. Smith is a Certified Health Physicist with a Masters degree in Environmental Engineering Sciences from the University of Florida. Mr. Smith has 17 years of professional nuclear experience in operational and environmental health physics activities. Currently working as a Senior Health Physicist for Westinghouse at the Savannah River Site (SRS). Responsibilities include source term identification of legacy materials, development of measurement and sampling methodologies, and is the site lead for in situ gamma assaying utilizing the Canberra ISOCS system.

Mr. Smith has served as technical lead for characterization and decommissioning projects at NASA (Wallops Flight Facility), SRS (Heavy Water Components Test Reactor - HWCTR), and Allied General Nuclear Services facilities in Barnwell South Carolina. Mr. Smith has performed research of the operational histories, developed site specific characterization plans, developed radiological source terms, conducted pathways analysis, and has developed release criteria.

Joseph Rossabi

Joe Rossabi is a fellow engineer in the Environmental Sciences and Technology Division of the Savannah River Technology Center where he performs applied research and development of environmental characterization and remediation technologies and strategies. His research involves field-testing and implementation of cone penetrometer-based characterization and remediation methods, multiphase flow processes including DNAPL fate and transport, and passive methods for characterization and remediation of subsurface contaminants. Dr. Rossabi was part of a team that deployed a cone penetrometer-based spectral gamma probe to characterize the Cesium plume at the R Reactor Seepage Basin site at SRS. He was also the principal investigator of DOE projects that successfully developed innovative DNAPL characterization methods, and implemented barometric pumping for subsurface characterization and remediation of volatile contaminants. Dr. Rossabi has numerous publications on subsurface characterization and remediation and has served on national committees (DOE and EPA) to review characterization and sensing technologies.

Before coming to the Savannah River Technology Center eleven years ago, Joe performed research and development in the areas of laser communications and atmospheric transmission and spectroscopy for Bell Laboratories in Holmdel, NJ and a defense contractor in McLean, VA. He has a Ph.D. in Environmental Engineering from Clemson University, an MS in Environmental Engineering from the University of North Carolina at Chapel Hill, and MS and BA degrees in Physics from the State University of New York at Binghamton.

APPENDIX C
TECHNICAL ASSISTANCE TEAM MEETING AGENDA

June 26-27, 2002 Miamisburg Environmental Management Project

Date:	Start:	Stop:	Event	Participant(s)
6/26/02	8:00 AM	8:30 AM	Badging at Visitor Office	All
	8:30 AM	9:45 AM	Introductions and Mound Problem Overview	D.Maynor/ M.Williams
	9:45 AM	10:00 AM	Break	
	10:00 AM	11:00 AM	Mound Tour of Piping	M.Williams
	11:00 AM	12:00 PM	Team Discussion of Mound Options/Solutions	All
	12:00 PM	1:00 PM	Lunch	
	1:00 PM	2:45 PM	Team Discussions of Mound Options/Solutions	All
	2:45 PM	3:00 PM	Break	
	3:00 PM	4:00 PM	Description of Ashtabula Problem	S. Altmayer
	4:00 PM	5:00 PM	Team Discussions of Ashtabula Solutions	All
6/27/02	8:00 AM	9:30 AM	Team Discussions of Ashtabula Solutions	All
	9:30 AM	9:45 AM	Break	
	9:45 AM	10:30 PM	Description of Columbus Problem	J. Poliziani
	10:30 AM	12:00 PM	Team Discussions of Columbus Solutions	All
	12:00PM	1:00 PM	Lunch	
	1:00 PM	3:30 PM	Continue Discussions, Prepare Recommendations/Briefing to Site Personnel	All

APPENDIX D
MAP AND DESCRIPTION OF ASHTABULA UNDERGROUND PIPING

Attached is an annotated drawing in pdf format that delineates nine sections of underground stormwater piping at AEMP that are in or near clean areas. The AEMP has U and Tc-99 contamination. The baseline assumes removal of all buried piping (except for the outfall pipe) based on inferred contamination above unrestricted release levels. However, some piping may be objectively clean below cleanup levels.

The key stretches of pipe suitable for in-situ surveying and potential unrestricted release are annotated on the drawing and summarized below. Many of these lines were pressure washed and videotaped in early 2002. Some had thick unremovable lime scale deposits. The measurements are estimates based on scaling and visual observation (grade = 637'elevation).

Run #	**Name**	**Location**	**Diameter (") x Length (')**	***Start (bsg)**	***End (bsg)**	**Material (Note 1)**
1	Metals Plant Drain	Area H (Metals to MH5	18" x 1,000'	tbd	tbd	1" Vitrified Clay w/ Bell Ends, 1950's
2	Parking Lot (MH-X covered)	Area F (MH5 to PLUG)	18" x 150'	tbd	tbd	Plugged 1970
3	Guard House	Area C (GH to MH4)	4" x 90' (4" at bldg.)	2'	3'	PVC, 1960's
4	ES&H Bldg.	Area C (OPS to MH2)	6" x 170' (4" at bldg.)	2'	11'	PVC, 1960's
5	Front Yard	Area C (MH4 to MH2)	18" x 120'	7'	13'	1" Vitrified Clay w/Bell Ends, 1950's
6	Modular Backyard	Area F (west to CB7)	4" x 200'	1'	2'	PVC, 1990
7	Modular Sideyard	Area F (CB7 to RF-6)	4" x 70'	2'	3'	PVC, 1990
8	Flowaug Pipe	Area D (MH1 to MH6)	24" x 100'	7'	tbd	PVC, 1998
9	Outfall Pipe (abandon in place)	Area D (MH6 to Outfall)	24" x 260'	tbd	20'	PVC, 1998

The objective is to gather data that could lead to a basis for unrestricted release to avoid the costs and risk associated with excavation and achieve final site closure commensurate with site owner, stakeholder, and Nuclear Regulatory Commission (NRC)] requirements.

APPENDIX E
PIPE INSPECTION TOOLS AND PIPE DEPLOYMENT PLATFORMS

(attached as excel files)